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ABSTRACT

Integration of In-flight and Post-flight Water Monitoring Resources in Addressing the U.S. Water Processor Assembly Total Organic Carbon (TOC) Anomaly

Beginning in June of 2010, the total organic carbon (TOC) concentration in the U.S. Water Processor Assembly (WPA) product water started to increase. A surprisingly consistent upward TOC trend was observed through weekly ISS total organic carbon analyzer (TOCA) monitoring. As TOC is a general organic compound indicator, return of water archive samples was needed to make better-informed crew health decisions on the specific compounds of concern and to aid in WPA troubleshooting. TOCA-measured TOC was more than halfway to the health-based screening limit of 3,000 µg/L before archive samples were returned.

Archive samples were returned on 22 Soyuz in September 2010 and on ULF5 in November of 2010. The samples were subjected to extensive analysis. Although TOC was confirmed to be elevated, somewhat surprisingly, none of the typical target compounds were detected at high levels. After some solid detective work, it was confirmed that the TOC was associated with a compound known as dimethylsilanediol (DMSD). DMSD is believed to be a breakdown product of siloxanes which are thought to be ubiquitous in the ISS atmosphere.

A toxicological limit was set for DMSD and a forward plan was developed for conducting operations in the context of understanding the composition of the TOC measured in flight. This required careful consideration of existing ISS flight rules, coordination with ISS stakeholders, and development of a novel approach for the blending of inflight TOCA data with archive results to protect crew health. Among other challenges, team members had to determine how to utilize TOCA readings when making decisions about crew consumption of WPA water. This involved balancing very real concerns associated with the assumption that TOC would continue to be comprised of only DMSD. Demonstrated teamwork, multidisciplinary awareness, and innovative problem-solving were required to respond effectively to this anomaly.

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